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CREW STRESS AND FATIGUE IN PROLONGED HELICOPTER MISSIONS

The Crested Rooster Program

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Aircrew stress and fatigue are being evaluated throughout prolonged helicopter (HH-53C) flights, as part of joint research by the ~~USAF~~ School of Aerospace Medicine ~~(Brooks AFB, Tex.)~~ and the AF Satellite Control Facility (SAMSO, Los Angeles, Calif.). Data concern such factors as: crew comfort modifications; fatigue and sleep; feeding systems; workload; heart rate; endocrine-metabolic indices of stress; and effects of a high noise/vibration environment. Information in this report is based on data from single long recovery missions. Tolerance to frequent long flights is not yet known, and will require further study.

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PREFACE

The willing cooperation of the crewmen from the 6594th Test Group (Hickam AFB, Hawaii) is gratefully acknowledged. Appreciation is likewise expressed to the following members of the USAF School of Aerospace Medicine: Mr. Edgar Williams, Mr. Roberto Miranda, Technical Sergeant David Freeze, Sergeant Cordell Gardiner, and Mr. Jesus Garcia--for their technical assistance; and to Drs. James Ellis and John E. Vanderveen--for their helpful advice and encouragement.

CONTENTS

FIGURES AND TABLES

Figure No.

Table No.

CREW STRESS AND FATIGUE IN PROLONGED HELICOPTER MISSIONS

The Crested Rooster Program

INTRODUCTION

During the Crested Rooster Modification Program, six HH-53C helicopters were successfully modified to perform a surface recovery mission for the Air Force Satellite Control Facility (AFSC/AFSCF). This mission entailed long-duration helicopter flights which could be extremely taxing for the crews. When the feasibility of the mission concept was first debated, serious questions of crew safety and acceptability were raised, because such demanding helicopter operations have generally been reserved for combat situations. Consequently, biomedical information and advice were sought from the Aerospace Medical Division, AFSC; and several crew-support requirements were identified (e.g., noise, seating, food, water, and waste management).

In addition, the joint Warner Robins Air Logistics Center (WRALC)-AFSCF test plan (10) included provisions for evaluating the crewmembers and their environment during long-range helicopter missions. [The vibration and noise characteristics of the HH-53C, with and without acoustical treatment, were determined by the Aerospace Medical Research Laboratory (AMRL) and will be reported separately by AMRL]. The School of Aerospace Medicine (USAFSAM) objectives were to: (a) assess aircrew stress and fatigue during long-duration HH-53C missions; and (b) assist WRALC and the 6594th Test Group (Hickam AFB, Hawaii) in determining the effectiveness of the crew comfort modifications.

METHODS

Various physiologic and psychologic measurements were taken from the crewmen on flight (mission) #8, the only long-duration test. Additional information on fatigue and sleep was collected from the HH-53C crew on several shorter missions, or aborted long missions, and from the officers of the C-130 tanker crew. All test subjects provided control data on a nonflying day, starting at least 24 hr after their most recent flight.

The "Subjective Fatigue Checklist" and "Sleep Survey" (in appendix A: SAM Forms 141 and 154, respectively) were forms which had been used many times before at USAFSAM. Consequently, our results could be interpreted in light of extensive experience with various flying operations. The fatigue forms were completed by crewmen every 4 hr during control and test days, while the sleep surveys were filled out each morning. Continuous ECGs were recorded from the pilot and copilot during mission 8.

Three chest leads, taped to each crewman, were connected to Avionics Electrocardiocorders strapped to the cockpit seats. The recordings were evaluated for heart rate and the occurrence of cardiac arrythmias by means of an Electrocardioscanner (Avionics Biomedical Div., Del Mar Engineering Labs., Los Angeles, Calif.) at USAFSAM.

Urine specimens were collected from each crewman shortly before takeoff, and every 4 hr thereafter at about the same times that the fatigue forms were completed. Onboard data collection was supervised by the senior pararescue specialist who functioned as biomedical monitor. Control specimens were collected every 4 hr during a preliminary nonflying day. Recovery data were collected every 4 hr after landing, until the morning after mission 8 when the crew departed Robins AFB (Ga.) for Hawaii. Each urine sample was voided into dilute HCl and frozen on dry ice. All specimens were later flown to USAFSAM for analysis. Urea was measured by AutoAnalyzer as an index of protein catabolism. Sodium and potassium were analyzed by flame photometer as measures of mineral metabolism. In these analyses, 17-hydroxycorticosteroids (17-OHCS) (12) served as an index of adrenocortical function, while norepinephrine and epinephrine (7) indicated sympathetic and adrenal medullary activity. Creatinine was also determined by AutoAnalyzer, not as a measure of stress, but rather as a base to which all other urinary constituents could be expressed as a ratio.

Because of recent reports of gastrointestinal hemorrhage in monkeys exposed to chronic vibration (1), examinations for occult blood were performed on aircrew stool and urine specimens pre- and post-flight. Hemoccult slides were used for Guaiac testing of stool specimens, while Labstix reagent strips were used on the urine.

A thermostabilized food concept, based on the system accepted for the B-1 bomber, was proposed and accepted for the Crested Rooster helicopters. A model of the proposed heating trays for use with the helicopters was sent to Robins AFB, so that a determination could be made as to whether the thermostabilized food concept could be incorporated into the recovery helicopter. In addition, a prototype of the B-1 heating device and three food items were shipped to Robins AFB for evaluation by Crested Rooster personnel, who were requested to fill out a "Food Evaluation Form" (appendix A: No.-USAF SCN 73-143) after sampling all items.

USAFSAM personnel attended briefings and debriefings to learn the experiences, impressions, and observations of the crewmen involved in the helicopter flights. One object was to detect any persistent or recurrent problems with the crew comfort modifications.

EDITOR'S NOTE: For further information on related research on thermostabilized foods at USAFSAM, the reader is referred to SAM-TR-74-11: B-52 Crew Evaluation of Thermostabilized Foods, July 1974; and SAM-TR-74-12: FB-111A Crew Evaluation of Thermostabilized Bite-sized Meats, July 1974.

RESULTS

Fatigue and Sleep

Subjective fatigue scores for the HH-53C crew are shown in Figure 1. Lower scores indicate greater fatigue. The fatigue induced by the long mission was not significantly different from that of the nonflying control day. As a whole, the crew felt less fatigued on the morning they began flight 8 than they did on the control morning. The "Sleep Survey Results" (Table 1) confirmed that they felt more rested on the morning of the long flight. The crew actually slept less the night before flight 8, however, than they did on the control night. Undoubtedly the high motivation of the crew, to complete the test program successfully, influenced their subjective fatigue. When the fatigue scores of HH-53C and C-130 tanker crews were compared for missions of equal duration, the scores of the helicopter crewmen were lower in all cases. The lowest score (average, 8.2), indicative of maximum fatigue, occurred at midnight after the long mission (Fig. 1). However, previous studies have demonstrated complete psychologic recovery from this level of fatigue after one normal sleep period. In this case, failure to recover to premission levels was a direct effect of the disturbed sleep--average, 5 hr--occasioned by the postmission celebration.

TABLE 1. SLEEP SURVEY RESULTS

	Pre-control day	Post-control day	Pre-flight 8	Post-flight 8
Average sleep (hr)	8	8.6	7.3	5
How well rested	Moderate	Moderate	Well	Slight

Electrocardiograms

The heart rates of the pilot and copilot during mission 8 are shown in Figure 2 (the key events indicated by numbers on the figure are listed in the legend). Heart-rate determinations were made every 30 min during cruise portions of the mission, and every 5 min during the noncruise segments. Both pilots demonstrated persistent tachycardia throughout the flight. The pilot's rate was consistently higher than that of the copilot, especially during maneuvers such as hovering and refueling. The highest rates occurred during the second refueling (128/min), and shortly before

EDITOR'S NOTE: All figures are grouped at the close of this report (between the "References" and appendix "A").

a premature landing necessitated by a recurrent chip light (130/min). Rhythm strips revealed no arrythmias, other than the sinus tachycardia already discussed.

Urinary Indices

The endocrine-metabolic indices of flight stress revealed little difference between the flight and control days. The excretion patterns (Figs. 3 and 4) for most urinary stress indices were not changed appreciably by the long helicopter flight. However, electrolyte and catecholamine levels were considerably higher at the start of the mission than at the comparable time on the control day; and later flight values tended to reapproach the baseline. Similarly, urea was lower on the mission day, but showed readjustment later. The values in Table 2 are the crew means for the last mission specimens and the comparable control collections made at about the same time of day. The electrolyte (Na, K, and their ratio) and catecholamine (epinephrine, norepinephrine, and their ratio) changes induced by the long flight are not significantly different from the control values when their normal circadian variations are taken into account. The increases in urea and 17-OHCS, observed during the long mission, approach statistical significance ($P < 0.1$). Since the individual variability is high for these measures, however, the small number of subjects ($N = 6$) involved in the test flight limits our ability to issue reliable generalizations and conclusions.

TABLE 2. ENDOCRINE-METABOLIC RESULTS

Urinary variable[a]	Test condition: Control	Test condition: Flight	Probability
Sodium (mEq)	6.4	7.7	NS[b]
Potassium (mEq)	2.2	2.6	NS
Ratio: Na/K	3.2	3.0	NS
17-OHCS (μg)	218.9	315.2	<0.1
Urea (mg)	745.1	643.6	<0.1
Epinephrine (μg)	1.30	1.13	NS
Norepinephrine (μg)	1.97	1.95	NS
Ratio: Norepi/Epi[c]	3.25	2.15	NS

[a]Each variable is expressed as a quantity/100 mg creatinine.
[b]NS = Not significant.
[c]Mean of ratios, not ratio of means.

Stool Guaiac

Stool specimens from all HH-53C crewmen were negative for occult blood before mission 8. Postflight Guaiac testing of the pilot's and

copilots' stool, as well as dip-stick checks of all crewmen's urine, revealed no occult blood. No clinically significant GI or GU hemorrhage was induced in the crew by the vibration and other stresses of long-duration helicopter flying.

Feeding Systems

Both the thermostabilized food concept and representative food items were evaluated during the helicopter modification program. The three entrees tested were rated as highly acceptable by members of the Crested Rooster test group (Table 3). Appearance of the food items (beef stew, roast beef, and bite-sized chicken) was rated between excellent and good for all products. The average rating for flavor and/or taste was very good for all products when rated on a 4-point hedonic scale of: excellent, very good, satisfactory, and undesirable. Overall acceptability of the three food items was rated as very good for all products when evaluated on a 5-point hedonic scale of: excellent, very good, good, fair and poor. Shown in Table 4 are the results of the general evaluation to determine the acceptability of thermostabilized foods for use aboard helicopters. According to these results, no problem was associated with removal of the tops from the cans, nor did handling the cans pose a significant hazard. Required intake of additional fluid was reported by 53% of evaluators. No significant problems were associated with amount of fluid in the cans, because the plastic covers provided adequate protection against spillage. Portion sizes were also adequate, and storage in the aircraft presented no difficulty. All of the evaluators felt that this system afforded better meals than the types presently being issued from inflight kitchens.

TABLE 3. AVERAGE RATINGS FOR THERMOSTABILIZED FOODS EVALUATED BY PERSONNEL (Crested Rooster Program)

	Rating[a]				
	Highest	Lowest	Beef stew	Bite-sized chicken	Roast beef
Appearance	1	3	1.66	1.26	1.56
Flavor and/or taste	1	4	2.21	1.78	1.86
Overall acceptability	1	5	2.13	1.60	1.81

[a]See sample of Food Evaluation Form (appendix A).

TABLE 4. RESULTS OF GENERAL EVALUATION OF THERMOSTABILIZED FOOD CONCEPT

Question	Yes Responses Number	Yes Responses Percent
1. Are tops easily removed from cans?	16	100
2. Does handling the can pose a hazard?	2	11
3. (Not Applicable)		
4. Was additional fluid intake required as a result of consumption of these food items?	7	53
5. Did the amount of fluid in the can create a problem? If so, list products.	1	6
6. Did the plastic covers for the cans provide adequate protection against spillage after consumption of food items?	16	100
7. Were portion sizes of sufficient quantity?	12	75
8. Was the storage of food a problem in the aircraft?	0	0
9. Would this system be acceptable as an alternative food system to your present meal system?	15	100
10. Is this food system (1) better, (2) the same, (3) worse than, the existing type meal you are getting from the inflight kitchen?	(1) better	100
	(2) same	0
	(3) worse	0

Debriefings

Several problems, malfunctions, and deficiencies of the basic aircraft and of the modifications were discussed during the test program debriefings. The USAFSAM personnel paid particular attention to complaints about the crew comfort modifications. Many discrepancies were identified and corrected during the testing, including:

1. Repositioning of hot-cup controls away from potential water spills.

2. Addition of doors to galley storage compartments.

3. Revision of liquid storage areas to facilitate insertion and quick removal of jugs (e.g., post-ditching).

4. Addition of hot-cup/food-tray support devices and storage receptacles.

5. Improvement of soundproofing fasteners to prevent separatic due to wind and vibration.

6. Rewiring of galley to prevent overheating.

Other problems were identified, but not solved. Foremost among these was difficulty with the seats. The crew comfort modification included three airline-type seats which, together with two pilots' seats, were intended to provide adequate accommodations for all five crewmen. The addition of a sixth crewmember necessitated continuous use of the flight mechanic's jump seat. This position lacks adequate back-support and is exceedingly uncomfortable during long missions. Although the crewmen alternated sitting in the jump seat to limit the exposure of any one person, all found it unacceptable. The other five seats were also somewhat uncomfortable on long flights. The new seats are too small for some crewmen; and the cloth covers might prove inadequate if they are repeatedly soaked with salt water during and after open-ocean recoveries. All seats should be evaluated to determine how their comfort may be increased.

The situation of the pilots would be improved by the addition of blocks to hold the weight of the parachutes off their shoulders while sitting. The pararescue specialists ("PJs") would be more comfortable if they had a better method of removing the salt from their bodies after returning to the helicopter. Presently, only towels are available. However, the location and storage of any additional equipment or supplies (e.g., fresh water) should be given careful consideration before installation. The crew comfort area is already too restricted for the PJs to dress there. Relocation of equipment, such as the pyrotechnic box, to another part of the aircraft would increase the space available to the crew.

The thermos jugs were not designed to withstand the vibrations encountered aboard the helicopter. Consequently, the spigots vibrated loose and the jugs began to leak during the flight. The high noise/vibration environment must be considered when available equipment is adapted for use in helicopters. Modification of the liquid storage containers will be necessary if leaking recurs during subsequent missions.

During debriefing, crewmembers indicated that the Army helmets used during the test flights were much more comfortable than the regular Air Force helmets because they were light in weight but still provided good noise protection. The light weight of the helmet was particularly advantageous when flying long missions of 10 or more hours.

Data on noise measurements will be provided by the 6570th Aerospace Medical Research Laboratory (AMRL). However, the subjective impression of the crew was that little or no difference could be detected after installation of the present noise-attenuation modification.

DISCUSSION

The physiologic data accumulated during the Crested Rooster flights may be interpreted via existing information on the stress of flying

rotary-wing aircraft (2, 3, 4, 5, 8, 11). Billings et al. (2) found that pattern flying in the Hiller 12-E increased oxygen uptake by 70% over resting values, while hovering in a crosswind doubled the metabolic rate. They contrast their results with those of Littel and Joy, who studied turbine helicopters with more sophisticated control systems comparable to those of the HH-53C. In the case of Littel and Joy, metabolic rates were lower, indicating that powered controls spared the pilot significantly. In either case, part of the increase in heart rate (e.g., 85-100 beats/min) represents the increased cardiovascular demand associated with a higher metabolic rate. Much of the persistent tachycardia observed in the Crested Rooster pilots was metabolically determined and was not evidence of inflight psychologic stress. However, several spikes of markedly increased heart rate were superimposed on the baseline tachycardia. Aerial refueling, hovering, and the appearance of a chip warning light during flight were all high-stress events. The occurrence of higher levels of stress in the aircraft commander than in other members of the crew has been observed in numerous studies and is reconfirmed by the Crested Rooster data.

Brown et al. (4) have described in detail the ECG findings from the first nonstop transatlantic helicopter flight, made in 1967 in two Sikorsky HH-3E helicopters. They also observed persistent elevation of heart rate above normal resting levels. They emphasized, however, the causative role of vibration itself; for significant tachycardias have been reported in both men and animals exposed to low-frequency vibrations. During the middle and later stages of that nearly 31-hr transatlantic flight, the mean heart rate decreased. This decrease was attributed to adaptation to the mixed frequency vibration of the helicopter. No such downward trend was evident during the Crested Rooster mission, but the flight may have been too short for adaptation to occur. Heart-rate data indicate that vibration and emotional stressors at key points in the mission produce demonstrable, but tolerable, increments in aircrew stress above and beyond the basic metabolic load imposed by flying the helicopter.

The results of the Crested Rooster endocrine-metabolic appraisal can be compared to the findings from 19 previous studies of human responses to flight conducted by USAFSAM (9). Several different aircraft and various missions, including the transatlantic HH-3E flights, have been investigated. In each case, an assigned workload was computed using a value taken from a 7-point complexity scale multiplied by a value from a 6-point duration scale. The complexity scale represented the degree of difficulty of flying the several aircraft in the studies, as determined by expert ratings from the USAF Directorate of Aerospace Safety, Norton AFB, California. The duration scale used 4-hr increments of a 24-hr period. Based on the resulting list of assigned loads, various combinations of physiologic variables were used to calculate <u>predicted</u> loads.

Multiple linear regression analysis was employed to determine which combination best predicted the assigned load. The best regression equations, shown as (<u>1</u>) and (<u>2</u>) below Figure 5, had r = 0.81 and r = 0.84,

respectively. By assuming that HH-53C complexity approximates that of the HH-3E, and by inserting the proper duration factor, the assigned workload for mission 8 is 18 (shown as X on Fig. 5). When the average within-flight urinary values for the HH-53C crew are substituted into equations (1) and (2), the corresponding predicted loads are, respectively, 12.7 and 7.4 [shown as •(1) and •(2) in Fig. 5]. In both cases, the points lie well below the regression line. The physiologic changes observed during this Crested Rooster long mission were smaller than we would have predicted from our previous experience with flying stress. The changes were considerably less than those of the transatlantic helicopter flight, in which occurred: a 143% gain in epinephrine; a 25% gain in urea; and a 51% reduction in the norepinephrine/epinephrine ratio (8). Calculation of predicted workloads at the 8- to 10-hr point of the transatlantic flight yielded values greater than 20 (i.e., above the regression line of Fig. 5). Acute, single-mission stress of the degree measured in the Crested Rooster crew poses no problems of operational significance. Chronic or cumulative stress from recurrent long flights is a different matter. Routine long-duration helicopter flights remain a potential problem of sufficient magnitude to warrant collecting additional data on crew stress and fatigue when the recovery system becomes operational.

Bleeding from the gastrointestinal tract after chronic exposure to vibration is a factor only recently recognized. Badger et al. (1) studied 19 adolescent male rhesus monkeys after prolonged exposure to sinusoidal vibration (12 Hz, 1.5 G_z peak) at a frequency of abdominal resonance. Occult blood was present in the stools of all vibrated animals in the first week of daily exposure (5 hr/day, 5 days/week). Thereafter, occult blood appeared cyclicly, indicating that some repair occurred between exposures. Necropsy demonstrated multiple lesions of the gastric mucosa in most cases, though a few animals had bleeding from the lower bowel. Bleeding routinely developed after a total of 20 hr or less of vibration. Fortunately, no bleeding from the gastrointestinal or urinary tracts was evident in the Crested Rooster crewmen. Their vibration environment was less stressful than that of the experiment, and included many frequencies besides those producing abdominal resonance. Furthermore, the exposure was shorter, and the crewmen were already conditioned by long experience in rotary-wing aircraft. Occult blood measurements should be repeated on crewmen chronically exposed to vibration stress, as well as those just beginning helicopter duty.

Fatigue and its primary determinant, sleep, are important because of the effects on operational efficiency. The main changes in performance, due to acute fatigue, are (11):

1. Deterioration in the accuracy of timing of the components of a skilled task.

2. Unconscious acceptance, by the pilot, of lower standards of accuracy and performance.

3. Disintegration of the perceptual field, so that the readings from individual instruments are no longer integrated into an overall pattern.

4. Narrowing of the pilot's range of attention, so that some instruments or tasks are forgotten or ignored.

Chronic fatigue, on the other hand, produces changes in the quality of decisionmaking, motivation, and morale, both inflight and on the ground. Acute fatigue did not occur to any significant degree in the Crested Rooster crew. Although they were admittedly tired after mission 8, the elation occasioned by their successful completion of the test program offset any subjective feelings of fatigue. This will not be the case when helicopter recovery becomes a routine operation. Boredom, resulting from many hours and frequently days spent on alert without flying, caused much more difficulty during the test program than did acute fatigue. Morale and motivation problems similar to those of chronic fatigue became evident, and will be so again if this situation recurs in the field. Boredom is also an inflight problem, particularly for crewmembers whose duties are limited primarily to the recovery phase of the mission. Expanding the helicopter intercom capability to include other channels (Automatic Direction Finder [ADF] for AM radio, low-frequency communications, etc.) would provide one means of counteracting inflight boredom.

A thermostabilized food concept based on the system accepted for the B-1 bomber was proposed for the helicopters in the Crested Rooster program. This feeding system was recommended because of its ability to provide the crewmembers with a hot meal, which would be safe for consumption after 5 hr of flight, and which would meet with minimal weight and volume requirements. Based on test data obtained from evaluation of the feeding system for the B-1 (6), a 50% savings in weight and volume over the frozen or refrigerated systems can be achieved and still provide a highly acceptable food system.

Before leaving Robins AFB, all the helicopters were modified to accept the thermostabilized feeding system. Based on the space available for incorporation of a feeding system, sufficient storage and preparation space was provided to insure that the system would be functional. Analysis of the food acceptability data and the general evaluation forms shows that, within the weight and volume limitations imposed, the thermostabilized food concept provides a highly acceptable feeding system.

CONCLUSIONS

USAFSAM participated in the Crested Rooster Modification Program to measure crew stress and fatigue during long-duration helicopter flights and to assist in evaluation of the HH-53C crew comfort modifications. Acute stress, of the degree measured in the helicopter crew during a single long recovery mission, posed no operationally significant problem. Electrocardiographic, endocrine-metabolic, and fatigue data demonstrated

that the mission profile was well within the physiologic and psychologic capability of the crew. Whether frequent long flights would be equally well tolerated is unknown, and this matter should be studied further.

Among the suggested HH-53C modifications, the following three biomedical areas were of primary concern:

(a) noise and vibration,

(b) food and water, and

(c) seating.

(a) The first area will be the subject of a separate report by AMRL. (b) The second has progressed to the stage of operational testing, using prototype food preparation items and water storage equipment. (c) The third area, however, remains a major unsolved problem. With the addition of a sixth crewman to each helicopter, one man is currently required to use a fold-down jump seat without adequate back support. The present seat must be radically revised, or a new type installed, for routine long-duration flights. All seats should be evaluated to determine how they can be made more comfortable for crewmen.

Additional observations and recommendations (as summarized in the report section on "Debriefings") should also be considered in the program to improve the inflight environment for helicopter crewmembers.

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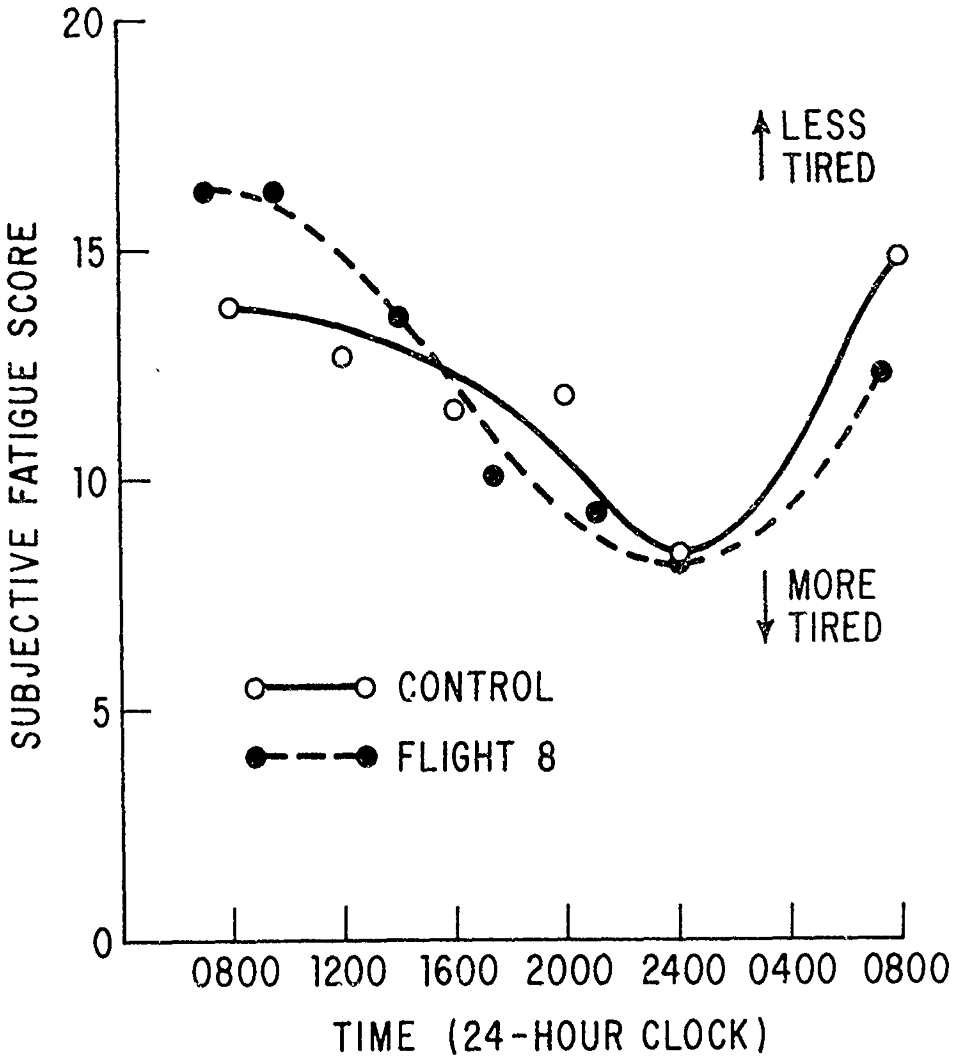


Figure 1. The HH-53C aircrew subjective fatigue scores.

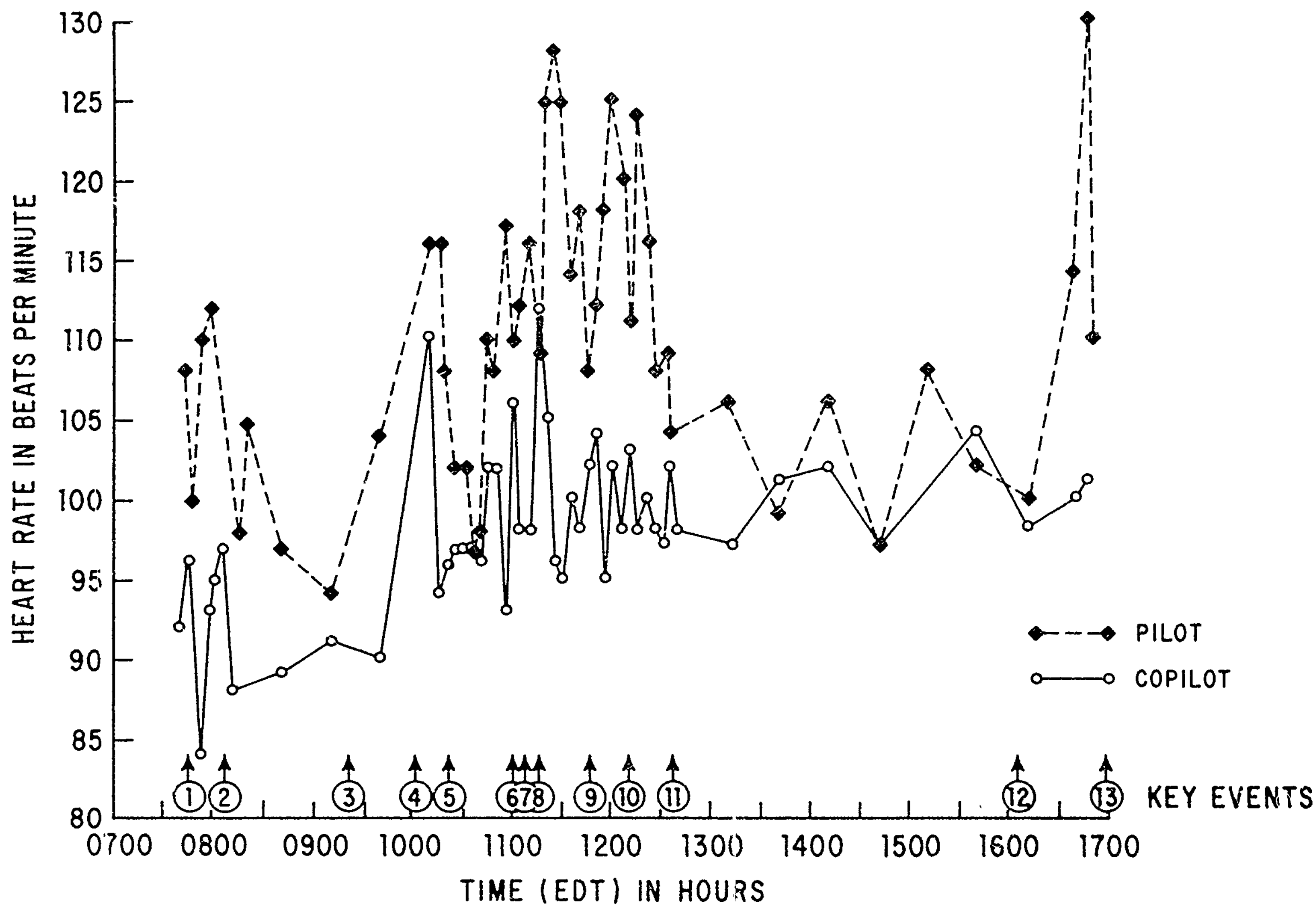


Figure 2. [legend and key are on facing page]

Figure 2. Aircrew heart rate during Mission 8.

Number	Time	Event
1	0745	Start engines
2	0800	Takeoff
3	0920	Arrive down-range
4	1000	Begin tanker rendezvous
5	1020	Complete aerial refueling
6	1102	Hover begins
7	1107	Shape deployed
8	1120	Begin tanker rendezvous
9	1143	Complete aerial refueling
10	1210	Hover begins
11	1234	Recovery complete
12	1600	First chip light
13	1655	Landing

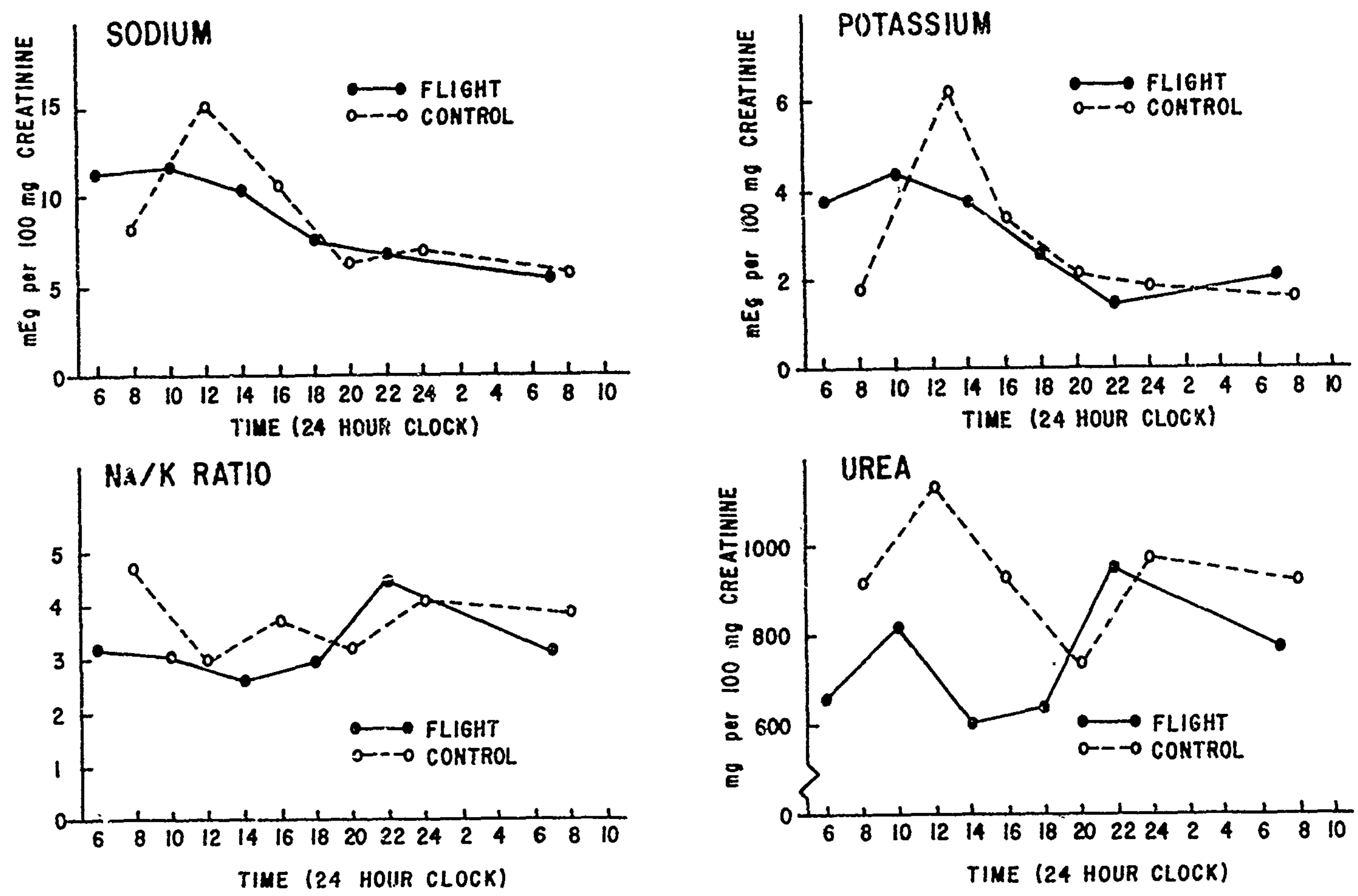


Figure 3. Electrolyte and urea excretion ("Crested Rooster" Program).

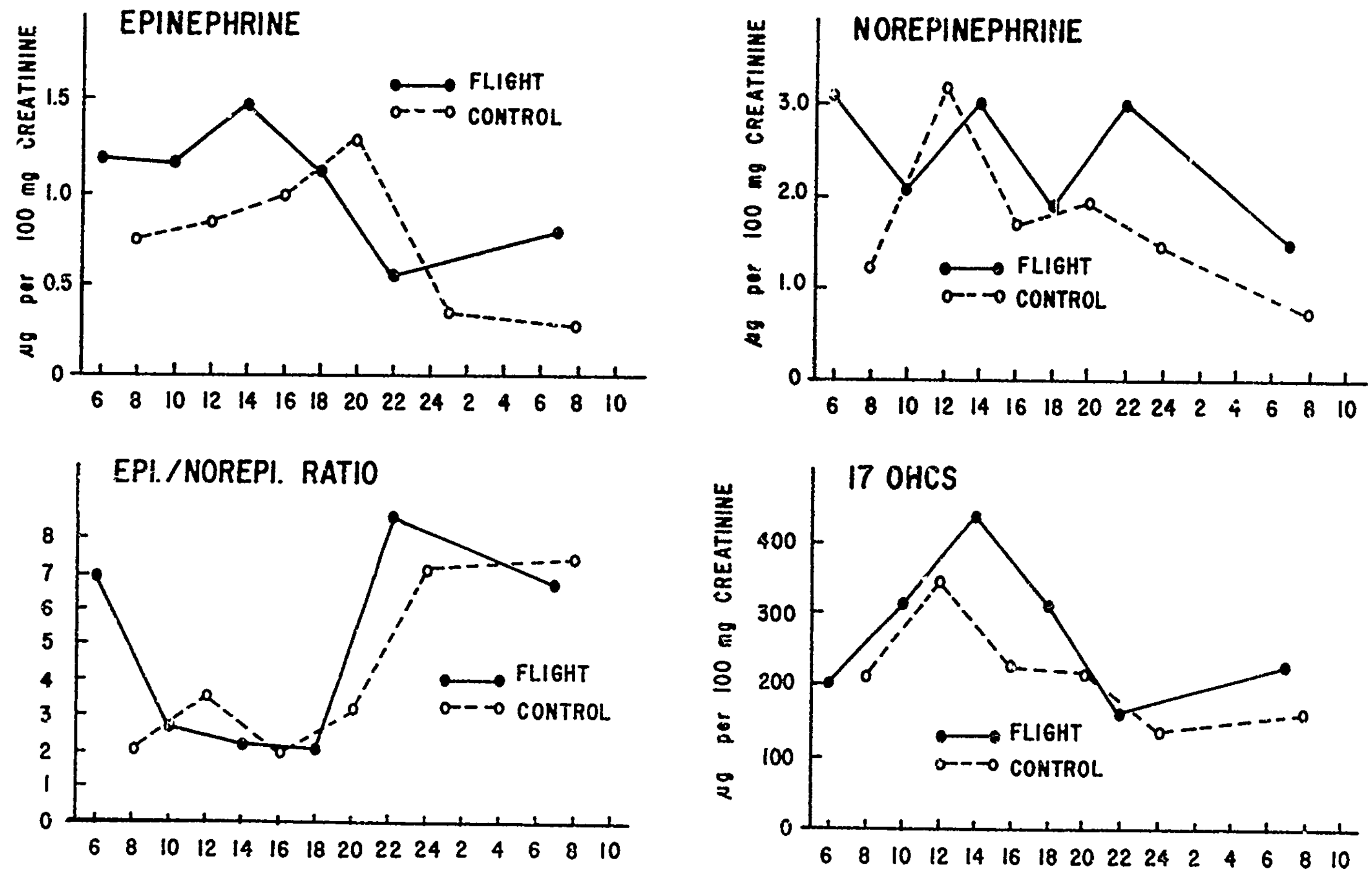
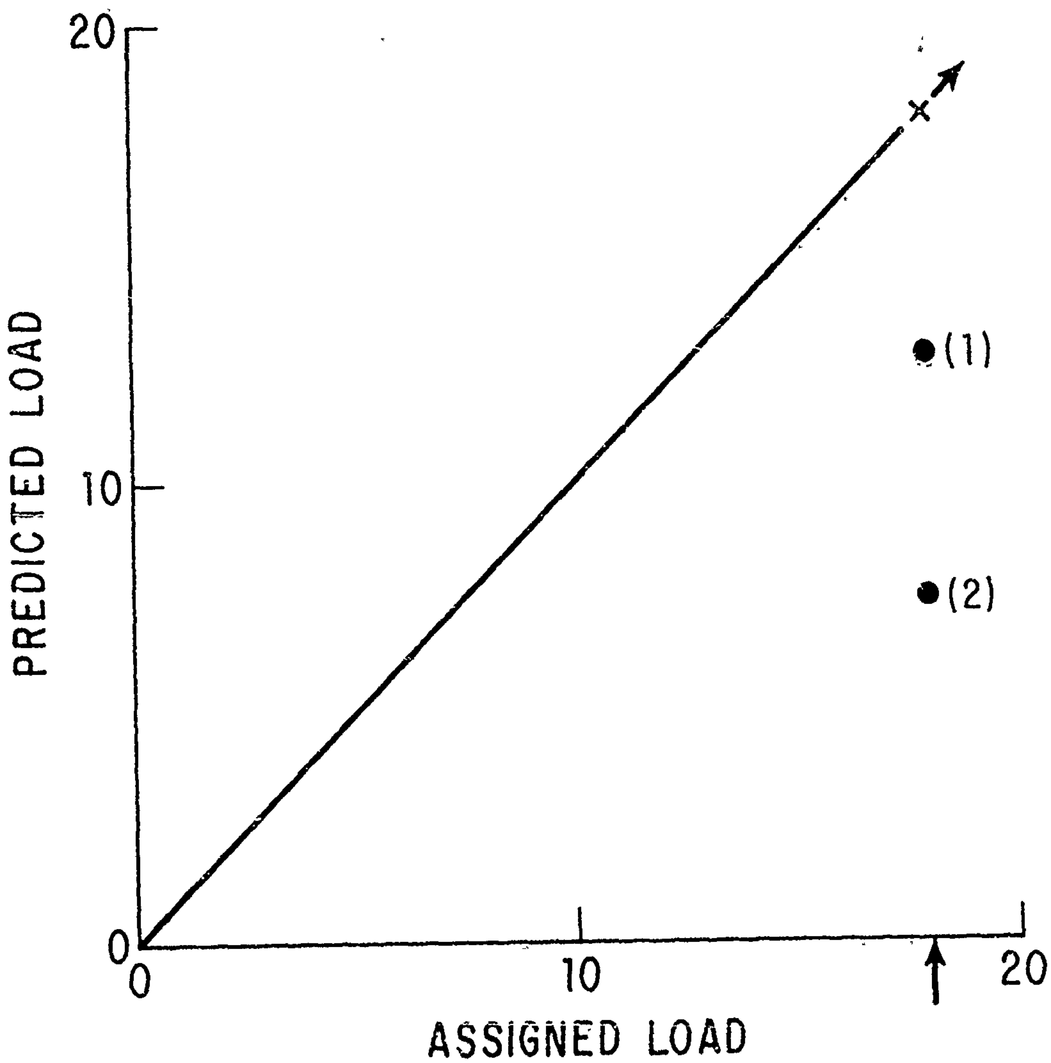


Figure 4. Hormone excretion (Crested Rooster Program).



× ASSIGNED LOAD (COMPLEXITY × DURATION)

(1) PREDICTED LOAD $(71.3 + 3.35\,Na + 7.42\,t - 17.9\,K - 12.1\,Na/K)$

(2) PREDICTED LOAD $(46.8 + 3.7\,NE + 6.16\,t - 9.70\,K - 6.70\,Na/K)$

Figure 5. The HH-53C aircrew workload.

APPENDIX A

SAMPLES OF THE FORMS FILLED OUT BY HELICOPTER CREWMEN

SUBJECTIVE FATIGUE CHECKLIST

DATE

SOCIAL SECURITY NUMBER | NAME (Last, First, MI) | CODE OR CASE NR.

RANK | TEST IDENTIFICATION

INSTRUCTIONS: Make one, and only one (✓) for each of the ten items. Think carefully about how you feel right now.

ITEM NR.	BETTER THAN	SAME AS	WORSE THAN	STATEMENT
1.				VERY LIVELY
2.				EXTREMELY TIRED
3.				QUITE FRESH
4.				SLIGHTLY POOPED
5.				EXTREMELY PEPPY
6.				SOMEWHAT FRESH
7.				PETERED OUT
8.				VERY REFRESHED
9.				FAIRLY WELL POOPED
10.				READY TO DROP

REMARKS

SAM FORM OCT 66 141

APPENDIX A (cont'd.)

SLEEP SURVEY

DATE

SOCIAL SECURITY ACCOUNT NR | NAME (Last, First, MI) | GRADE

AGE | AFSN | PRIMARY DUTY

1. On the chart below, mark an X for each half hour to indicate how much you slept in the past 24 hours. Now use the chart to show how well you slept. Use 1 to show drowsy or light sleep, 2 to show moderate or average sleep, and 3 to show deep sleep. Write those numbers below the X's.

DAYTIME

	0600	0700	0800	0900	1000	1100	1200 (Noon)	1300	1400	1500	1600	1700	1800
HOW MUCH													
HOW WELL													

NIGHTTIME

	1800	1900	2000	2100	2200	2300	2400 (Midnight)	0100	0200	0300	0400	0500	0600
HOW MUCH													
HOW WELL													

2. HOW MUCH TROUBLE DID YOU HAVE GOING TO SLEEP LAST NIGHT?

[ ] NONE [ ] SLIGHT [ ] MODERATE [ ] CONSIDERABLE

3. HOW MANY TIMES DID YOU WAKE UP LAST NIGHT?

4. HOW RESTED DO YOU FEEL?

[ ] WELL RESTED [ ] MODERATELY RESTED [ ] SLIGHTLY RESTED [ ] NOT AT ALL

5. DO YOU FEEL LIKE YOU COULD HAVE USED SOME MORE SLEEP?

[ ] YES [ ] NO

6. HOW MUCH DID YOU DREAM LAST NIGHT?

[ ] NONE [ ] SLIGHT [ ] MODERATE [ ] CONSIDERABLE

7. HOW MANY DREAMS DID YOU HAVE?

REMARKS

SAM FORM MAY 69 154 PREVIOUS EDITIONS OF THIS FORM MAY BE USED

APPENDIX A (cont'd.)

(Food Evaluation Form)

Authorization No. - USAF SCN 73-143

Name:______________________ Grade:_______ Crew Position:________ Date:__________

	Yes	No	1	2	3
1. Are the tops easily removed from cans?					
2. Does handling the can pose a hazard?					
3. Is this food system hazardous at high altitude? Not applicable)	---	---			
4. Was additional fluid intake required as a result of consumption of these food items?					
5. Did the amount of fluid in the can create a problem? If so, list products?					
6. Did the plastic covers for the cans provede adequate protection against spillage after consumption of food items?					
7. Were portion sizes of sufficient quantity?					
8. Was the storage of food a problem in the aircraft?					
9. Would this system be acceptable as an alternative food system to your present meal system?					
10. Is this food system (1) better, (2) the same, (3) worse than the existing type meals you are getting from the in-flight kitchen?					

Circle One Best or Right Answer in Each Box Below for Each Product.

Product	Beef Stew	Bite Size Chicken	Roast Beef
Appearance	Excellent Good Poor	Excellent Good Poor	Excellent Good Poor
Flavor and/or Taste	Excellent Very Good Satisfactory Undesirable	Excellent Very Good Satisfactory Undesirable	Excellent Very Good Satisfactory Undesirable
Overall Acceptability	Excellent Very Good Good Fair Poor	Excellent Very Good Good Fair Poor	Excellent Very Good Good Fair Poor

11. Please give your personal feelings as to the overall acceptability of the concept on the back of this form.

USAF SCHOOL OF AEROSPACE MEDICINE
AEROSPACE MEDICAL DIVISION (AFSC)
BROOKS AFB TX 78235